

Group IB metals (copper), Group VIII metals (iron), and Group 5B metals (vanadium) on a ceramic support which may comprise silica-zirconia.

However, there is no motivation to combine the teachings of the references. Neither Murachi et al. nor Manson et al. teach or suggest using the specific claimed combination of a platinum catalyst on a zirconia-silica support. As taught in the present invention, the use of platinum with a zirconia-silica support provides a significant enhancement in low-temperature activity and thermal stability compared with other catalysts prepared on silica or zirconia **alone**. See the specification at page 4, lines 15-22 and the examples. Neither Murachi et al. nor Manson et al. recognize the advantages of using a platinum catalyst on a zirconia-silica support. In fact, Manson teaches a number of different suitable support materials including the use of silica and zirconia alone, which is in contrast to the teaching of the present invention.

Applicants also note that while Manson teaches the optional inclusion of platinum with his catalyst, his catalyst **requires** the inclusion of copper, iron, and vanadium compounds. There is no teaching in Manson which would lead one skilled in the art to use a platinum catalyst on a zirconia-silica support in the absence of these required compounds. One would have to discount the importance of Manson's essential compounds in order to do so.

Further, Manson et al. are not concerned with the problem of converting NO to NO₂ at low temperatures, i.e., between 175 and 250°C as recited in amended claim 1. Rather, Manson et al. teach that their catalyst composition is very active and self-generating at a temperature of **380°C**. See Example 2. And, Murachi et al. are silent with regard with regard to the temperature at which NO is converted to NO₂. Applicants also note that neither Manson et al. nor Murachi et al. teach or suggest the conversion of about 60% to 96% of NO to NO₂ at the claimed temperature range as recited in claim 17.

With regard to claim 23, Applicants note that the Examiner refers to Col. 3, lines 55-61 of Manson et al. as teaching that oxidation of particulate occurs at a temperature between about 280 to 427°C. However, this teaching refers to EP No. 658369, copy enclosed, which teaches a trap for burning particulates in an exhaust gas at a temperature of less than 500°C. There is no teaching or suggestion in the reference of the conversion of NO to NO₂ at low temperatures, i.e., between about 175°C to 250°C as recited in amended claim 10. Rather, the EP patent is concerned with burning particulates at a temperature no greater than 500°C so as to avoid thermal stress in the trap which could cause cracking and/or damage to the trap components.

Claims 5 and 19 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Manson and further in view of Andreasson et al. (WO 99/39809). The Examiner has cited Andreasson for teaching the use of a second, selective reduction catalyst in conjunction with an oxidation catalyst in an exhaust system, asserting that it would have been obvious to utilize such a catalyst in the "modified Murachi system". However, as pointed out above, there is no motivation to modify Murachi et al. as none of the cited references teach or suggest an oxidation catalyst comprising platinum on a zirconia-silica support, nor do they teach or suggest the conversion of NO to NO₂ at temperatures between 175°C and 250°C using such an oxidation catalyst as recited in amended claims 1 and 10, from which claims 5 and 19 depend.

Claims 6 and 20 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Manson and further in view of Khair et al. (U.S. Patent No. 6,293,096). The Examiner has cited Khair et al. for teaching the use of a NO_x trap positioned downstream from an oxidation catalyst, asserting that it would have been obvious to use such a trap in the "modified Murachi system". Again, none of the references teach or suggest an oxidation catalyst comprising platinum on a zirconia-silica support where the conversion of NO to NO₂ takes place at a temperature between

about 175°C and 250°C as recited in amended claims 1 and 10, from which claims 6 and 20 depend. And, as pointed out above, there is no motivation to combine the teachings of the references.

Claims 7 and 11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Manson and further in view of design choice. The Examiner acknowledges that neither Murachi et al. nor Manson teach the claimed amounts of platinum, zirconia, and silica, but reasons that the claimed ranges would have been an obvious matter of design choice. Applicants disagree. As neither Murachi et al. nor Manson even teach or suggest using the specific combination of platinum on a zirconia-silica support, it is not believed that the amounts of the components of the oxidation catalyst would have been obvious. And, neither Murachi et al. nor Manson teach the claimed NO conversion temperatures recited in claims 1 and 10, from which claims 7 and 11 depend.

Claims 8, 9, 15 and 16 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Manson and further in view of Yoshimoto et al. (JP 02-056250). The Examiner has cited Yoshimoto et al. for teaching a method of forming oxides on a catalyst carrier which may include the use of TiO₂, WO₃, and a heteropolyacid. However, there is no teaching or suggestion in Yoshimoto of adding oxides or heteropolyacids to an oxidation catalyst comprising platinum on a zirconia-silica support as taught in the present invention. And, as pointed out above, none of the references teach or suggest the use of platinum on a zirconia-silica support which results in the claimed low conversion temperatures.

Claims 12-14 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Manson and further in view of Cooper et al. (U.S. 4,902,487) and design choice. While the Examiner acknowledges that neither Murachi et al. nor Manson teaches the claimed pretreatment of the catalyst, he asserts that it would have been obvious to do so in view of Cooper et al., who teach the use of NO₂ to

combust particulate on a filter using a catalyst such as platinum, palladium, etc. The Examiner refers to the Examples of Cooper et al., which show a platinum catalyst on a ceramic honeycomb monolith which is treated with a combination of gases including NO, O₂ and the balance N₂. However, Cooper does not teach or suggest that the treatment is carried out at a temperature between about 500 to 650°C as recited in claim 14. Further, Cooper et al. are silent as to the conversion temperature of NO to NO₂. And, as none of the references teach or suggest the combination of a platinum catalyst on a zirconia-silica support, there is clearly no motivation to combine the teachings of the references.

Claims 21 and 22 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Murachi et al. in view of Manson and design choice. While the Examiner admits that Murachi et al. are silent with regard to the conversion temperature, he asserts that these limitations “merely recite the operational range of virtually all oxidizing catalysts” and that obtaining the claimed range would have been obvious to one skilled in the art. However, as taught in applicants’ specification, this is clearly not the case. The use of any oxidizing catalyst does not result in low conversion temperatures. As taught in the specification, it is the combination of a platinum catalyst on a zirconia-silica support which results in high conversion of NO to NO₂ at low temperatures. The Examiner is referred to applicants’ Example 1 in which it is clear that the use of an oxidation catalyst comprising platinum on a zirconia-silica support results in a higher conversion of NO to NO₂ at lower temperatures than the use of an oxidation catalyst comprising a support containing silica alone.

Further, applicants wish to point out that Murachi et al. teach the use of an electric heater 5a which is used to heat the temperature of the exhaust gas. See col. 4, lines 17-22.

Claim 26 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Twigg et al. (U.S. 6,294,141) in view of Manson. Twigg et al. teach an emission control


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system for diesel engines including a first catalyst for converting NO to NO₂ and a second catalyst for oxidizing particulate. The first catalyst comprises Pt on a metal monolithic support. The second catalyst may comprise either oxidation catalysts or three-way catalysts. The Examiner has taken the position that it would have been obvious to use the zirconia-silica support of Manson in the first oxidation catalyst of Twigg et al. Again, the Examiner has provided no substantive reasoning as to why one skilled in the art would be motivated to do so. Twigg et al. specifically teaches that the first catalyst should be supported on a **metal** monolith, not a ceramic support as claimed. Twigg et al. teach that the metal monolith is preferred because it provides flexing and vibration of the honeycomb cell walls to displace any soot particles captured in the monolith. See the paragraph bridging columns 1 and 2. There is clearly no motivation to make the proposed substitution. Further, neither Twigg et al. nor Manson teach or suggest the conversion of NO to NO₂ at a temperature between about 175°C and 250°C as claimed.

For all of the above reasons, applicants submit that claims 1-20 and 22-26, as amended, are patentable over the cited references. Early notification of allowable subject matter is respectfully requested.

Respectfully submitted,

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APPENDIX
VERSION WITH MARKINGS TO SHOW CHANGES MADE
IN THE CLAIMS

1.(Amended) A diesel exhaust gas treatment system comprising:

an oxidation catalyst positioned in an exhaust gas passage of a diesel engine for converting at least a portion of NO contained in said exhaust gas to NO₂ at a temperature between about 175°C to 250°C, said oxidation catalyst comprising platinum and a support material comprising zirconia-silica; and
a particulate filter for receiving said exhaust gas.

10.(Amended) A method for treating diesel exhaust gases comprising:

positioning an oxidation catalyst in an exhaust gas passage of a diesel engine, said oxidation catalyst comprising platinum and a support material comprising zirconia-stabilized silica;
providing a particulate filter downstream of said oxidation catalyst;
exposing said oxidation catalyst to diesel exhaust gas containing NO such that at least a portion of said NO contained in said exhaust gas is converted to NO₂ at a temperature between about 175°C to 250°C; and
passing said NO₂ through said particulate filter in an amount sufficient to oxidize particulate matter trapped on said filter.

24.(Amended) A method for treating diesel exhaust gases comprising:

- positioning an oxidation catalyst in an exhaust gas passage of a diesel engine, said oxidation catalyst comprising platinum and a support material comprising zirconia-stabilized silica;

- providing a particulate filter in combination with said oxidation catalyst;

- exposing said oxidation catalyst to diesel exhaust gas containing NO such that at least a portion of said NO contained in said exhaust gas is converted to NO₂ at a temperature between about 175°C to 250°C; and

- passing said NO₂ through said particulate filter in an amount sufficient to oxidize particulate matter trapped on said filter.

25.(Amended) A diesel exhaust gas treatment system comprising:

- a particulate filter for receiving diesel exhaust gas from a diesel engine;

- an oxidation catalyst for converting at least a portion of NO contained in said diesel exhaust gas to NO₂ at a temperature between about 175°C to 250°C, said oxidation catalyst comprising platinum and a support material comprising zirconia-silica; wherein said oxidation catalyst is impregnated in said particulate filter.

26. (Amended) A diesel exhaust gas treatment system comprising:

- a first oxidation catalyst for converting at least a portion of NO contained in said diesel exhaust gas to NO₂ at a temperature of between about 175°C to 250°C, said oxidation catalyst comprising platinum and a support material comprising zirconia-silica; and

- a second oxidation catalyst different from said first oxidation catalyst; wherein said first and second oxidation catalyst are positioned in combination in the exhaust gas passage of a diesel engine.